

***Application  
for  
United States Letters Patent***

***To all whom it may concern:***

***Be it known that We,***

***Christer FAHRAEUS, Petter ERICSON, Linus WIEBE***

***have invented certain new and useful improvements in***

***NOTEPAD***

***of which the following is a full, clear and exact description:***

UNITED STATES PATENT APPLICATION

OF

CHRISTER FÅHRAEUS, PETTER ERICSON  
AND  
LINUS WIEBE

FOR

NOTEPAD

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code on the activation icon is/are predetermined to represent the activation icon, but in contrast to the "continuous" embodiment, the position/positions is/are unrelated to the actual location of the activation icon on the product.

In a preferred embodiment, the position code with which the activation icon is provided constitutes a first subset of an absolute position code which codes coordinates for points on a imaginary surface, the first subset coding coordinates for at least one point on the imaginary surface, which point is dedicated to initiation of said operation.

The position code can advantageously code coordinates for a large number of points or positions, much larger than the number of required positions on the product with the writing surface. The coordinates for all the points coded by the position code can jointly be said to constitute an imaginary surface. This property of the position code of being able to code a very large number of points can be used to increase the functionality of the position code. More specifically, one or more points on the imaginary surface can be dedicated to initiation of a specific operation. This point always represents the same thing independently of on which product and where on this product it is used. This construction facilitates the design of a new system with many different products

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cularly simple and reliable to detect and image process since it merely requires identification of a marking which can be identical for all the symbols.

The product can be any type of product having a writing surface and at least one activation icon. It may consist of two physically separate parts, the writing surface with the position code being located on one part and the activation code on the other. Alternatively, it may consist of a single part incorporating both the activation icon and the writing surface. The activation icon can then be positioned on the writing surface or on some other surface. The product can be, for example, a sheet of paper with a writing surface with a position code on one part of the paper and an activation icon on another part. In a preferred embodiment, the product is a notepad with a plurality of writing surfaces.

The different sheets of the notepad can be identical, in which case the position code thus codes the same positions on all the sheets. In an alternative embodiment, however, the position code codes different positions on the different sheets so that an identification of the sheets can be made on the basis of the positions coded by the position code.

Alternatively, the product can be a paper product consisting of at least one sheet comprising said writing surface, at least part of a surface of the sheet being coated with a preferably weakly adhesive layer.

Such a product can be used in the same way as the products sold under the trademark Post-It, but with the advantage that what is written on the product can simultaneously be recorded electronically.

Moreover, according to a second aspect, the invention relates to a device for information management, which is adapted to electronically record information which is being written on a writing surface. The device is further adapted to initiate a predetermined operation which uses the electronically recorded information when it detects a predetermined activation icon.

An advantage of this device is that is easy to use since the user need not learn different commands and need not press different buttons to open a desired program.

As mentioned above, the device will at least initiate, however possibly with a certain delay, the predetermined operation when the icon is detected. Depending on which functions are available in the device, it can in some cases carry out the entire operation. In other cases, the device can, for instance, automatically transfer the recorded information and information about which operation is to be carried out to an external unit, such as a PC or mobile telephone, which finishes the operation. This transfer can occur immediately or on a later occasion. By "initiate" is here meant that the device ensures that the operation is carried out even if it does not carry out the operation itself, so that the user need





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advantageous since it enables the use of the same technique for recording of information and for detection of the activation icon.

As stated above, the activation icon can be designed in various ways, and therefore different types of sensors can be used in the device depending on the technique with which the activation icon is implemented. In a preferred embodiment, the device is, as stated above, adapted to detect the activation icon by means of a position code with which the activation icon is provided.

It is per se possible to implement the device with two sensors of the same or of a different type, but the device will be less expensive and easier to use if it is implemented with a single sensor for both recording of information and detection of the activation icon, preferably in the form of a position code.

The sensor is advantageously an optical sensor which is adapted to record images of the writing surface. The optical sensor is advantageous since it allows the recording of information and the initiation of the predetermined operation to be based on image processing which is a well-known and well-developed technique.

In a preferred embodiment, the device further comprises a signal processor which is adapted to detect, in a signal from said at least one sensor, the activation icon and the recorded information for initiation of the predetermined operation.

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The signal processor can be implemented, for example, with a microprocessor with suitable associated circuits and software or as an ASIC (Application Specific Integrated Circuit), or as an FPGA (Field Programmable Gate Array) or similar programmable circuits. In the input signal which it receives, it need be able to identify what constitutes the activation icon and what constitutes the recorded information that the operation corresponding the activation icon is to use.

If the activation icon and the recorded information are detected with two different sensors, for example with an optical sensor and an accelerometer, respectively, this is easy since the signal processor then receives signals from two different sources.

As mentioned above, however, both the information and the activation icon are advantageously recorded by means of a position code. In a preferred embodiment, the signal processor is then adapted to receive the position code recorded by said at least one sensor, to determine which position the recorded position code codes, to determine, on the basis thereof, whether the position code relates to the writing surface, in which case the position is processed as representing information that has been written on the writing surface, or to the activation icon, in which case the predetermined operation corresponding to the position is initiated.



written information is processed as graphical information.

In a preferred embodiment, the device further comprises a memory for storage of the recorded information. This means that the device can be used in a stand-alone mode quite independently of other units. The user can record information and indicate which operation is to be carried out, whereupon the device carries out the operation when there is a possibility, for example when it gets into contact with an external unit, and then fetches recorded information from the memory. The device thus need not initiate the operation immediately as the activation icon is detected.

It is desirable that it should be possible to carry out a plurality of different operations for different notes that are written on different occasions on different parts of one and the same writing surface. This means that the device must know which part of the recorded information is to be used when a predetermined operation is to be executed.

In order to solve this problem, the device is in one embodiment adapted to use, when initiating the predetermined operation, that part of the information which has been recorded from the writing surface during a predetermined period. The period can be an absolute period or a relative period, for instance the period after the immediately preceding detection of an activation icon. In



advantageously a radio transceiver utilizing the so-called Bluetooth technology. It can alternatively be some other transceiver which can communicate wirelessly at a distance of less than about 100 m, e.g. an IR transceiver, an ultrasonic transceiver, a transceiver using ordinary light or a radio transceiver operating according to the Air-port technology.

The entire device can advantageously be arranged in one casing, but in an alternative embodiment it is also conceivable that the sensor or sensors, i.e. the part used by the user to record the information and the activation icon, can be located in a first casing while the signal processor, i.e. the part initiating the predetermined operation on the basis of the detected activation icon, can be located in a second casing.

The communication between the first and the second casing can take place wirelessly or via cable. The second casing can be e.g. a personal computer, the signal processor being software which is installed in the personal computer. It is also conceivable that some processing of e.g. the recorded position code occurs in the first casing before the transfer to the second casing occurs.

In a more advanced and, thus, technically more complicated and more expensive design, the device comprises a mobile telephone transceiver for transferring the recorded information from the device to an external unit, the predetermined operation being an operation from the







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Figs 8a and 8b show a paper product according to a second embodiment of a product according to the invention, and

Fig. 9a shows the function of a computer program stored on a storage medium according to the invention, and

Fig. 9b is a block diagram which illustrates the steps corresponding to instructions of such a program.

#### Detailed Description of a Preferred Embodiment

Below follows a description of the currently most preferred embodiment of the invention in the form of a notepad sheet and a device for use together with the notepad sheet. Subsequently, alternative embodiments will be described.

#### THE PRODUCT

##### Writing Surface

Fig. 1 shows a product in the form of a notepad sheet 1 of paper. The sheet 1 has a writing surface 3, a command field 4 and an address area A.

On the writing surface 3 there is printed a position code 5 which is composed of symbols. Each symbol comprises a marking in the form of a dot 6. The location of the dot 6 in relation to an imaginary raster extending over the writing surface determines the value of the symbol. For the sake of clarity, the position code is shown schematically on only a small part of the writ-

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Now follows a description of an alternative type of floating position code which is the presently most preferred position code. This position code is the subject matter of Applicant's Swedish Patent Application No. 9903541-2 that was filed on 1 October 1999. It is below referred to as a position-coding pattern since a surface to which the position code is applied gives a slightly patterned impression.

Fig. 2 shows an enlarged part of the sheet in Fig. 1 which on its surface 2 is provided with the position-coding pattern 5. The sheet has an x coordinate axis and a y coordinate axis.

The position-coding pattern comprises a virtual raster which neither is visible to the human eye nor can be detected directly by a device which is to determine positions on the surface, and a plurality of symbols which each can assume one of four values "1" - "4" as will be described below.

The position-coding pattern is arranged in such a manner that the symbols on a partial surface of the sheet of paper code absolute coordinates of a point on an imaginary surface, which will be described below. A first and a second partial surface 25a, 25b are indicated by dashed lines in Fig. 2. That part of the position-coding pattern (in this case 4 x 4 symbols) which is to be found on the first partial surface 25a codes the coordinates of a first point, and that part of the position-coding pat-

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tern which is to be found on the second partial surface 25b codes the coordinates of a second point on the imaginary surface. Thus the position-coding pattern is partially shared by the adjoining first and second points. Such a position-coding pattern is in this application referred to as "floating".

Figs 3a-3b show an embodiment of a symbol which can be used in the position-coding pattern. The symbol comprises a virtual raster point 30 which is represented by the intersection between the raster lines, and a marking 6 which has the form of a dot. The value of the symbol depends on where the marking is located. In the Example in Fig. 3, there are four possible locations, one on each of the raster lines extending from the raster points. The displacement from the raster point is equal to all values. In the following, the symbol in Fig. 3a has the value 1, in Fig. 3b the value 2, in Fig. 3c the value 3 and in Fig. 3d the value 4. Expressed in other words, there are four different types of symbols.

It should be pointed out that the dots can, of course, have a different shape.

Each symbol can thus represent four values "1-4". This means that the position-coding pattern can be divided into a first position code for the x coordinate, and a second position code for the y coordinate. The division is effected as follows:



Symbol value	x-code	y-code
1	1	1
2	0	1
3	1	0
4	0	0

The coordinates for each point is coded by means of a plurality of symbols. In this example, use is made of 4x4 symbols to code a position in two dimensions, i.e. an x-coordinate and a y-coordinate.

The series can maximally be 16 bits long if it is to have the above-described characteristic for sequences of

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"0 0 0 1 0 1 0".

This series contains seven unique sequences of four bits which code a position in the series as follows:

Position in the series	Sequence
0	0001
1	0010
2	0101
3	1010
4	0100
5	1000
6	0000

For coding the x-coordinate, the number series is written sequentially in columns across the entire surface that is to be coded. The coding is based on the difference or position displacement between numbers in adjoining columns. The size of the difference is determined by the position (i.e. with which sequence) in the number series, in which one lets the column begin. More specifically, if one takes the difference modulo seven between on the one hand a number which is coded by a four-bit sequence in a first column and which thus can have the value (position) 0-6, and, on the other hand, the corresponding number (i.e. the sequence on the same "level") in an adjoining column, the result will be the

same independently of where along the two columns one makes the comparison. By means of the difference between two columns, it is thus possible to code an x-coordinate which is constant for all y-coordinates.

Since each position on the surface is coded with 4x4 symbols in this example, three differences (having the value 0-6) as stated above are available to code the x-coordinate. Then the coding is carried out in such manner that of the three differences, one will always have the value 1 or 2 and the other two will have values in the range 3-6. Consequently no differences are allowed to be zero in the x-code. In other words, the x-code is structured so that the differences will be as follows:  
(3-6) (3-6) (1-2) (3-6) (3-6) (1-2) (3-6) (3-6) (1-2) ...  
Each x-coordinate thus is coded with two numbers between 3 and 6 and a subsequent number which is 1 or 2. If three is subtracted from the high numbers and one from the low, a number in mixed base will be obtained, which directly yields a position in the x-direction, from which the x-coordinate can then be determined directly, as shown in the example below.

By means of the above described principle, it is thus possible to code x-coordinates 0,1,2..., with the aid of numbers representing three differences. These differences are coded with a bit pattern which is based on the number series above. The bit pattern can finally be coded graphically by means of the symbols in Fig. 3.

In many cases, when reading 4x4 symbols, it will not be possible to produce a complete number which codes the x-coordinate, but parts of two numbers. Since the least significant part of the numbers is always 1 or 2, a complete number, however, can easily be reconstructed.

The y-coordinates are coded according to the same principle as used for the x-coordinates. The cyclic number series is repeatedly written in horizontal rows across the surface which is to be position-coded. Just like in the case of the x-coordinates, the rows are allowed to begin in different positions, i.e. with different sequences, in the number series. However, for y-coordinates one does not use differences but codes the coordinates with numbers that are based on the starting position of the number series on each row. When the x-coordinate for 4x4 symbols has been determined, it is in fact possible to determine the starting positions in the number series for the rows that are included in the y-code in the 4x4 symbols. In the y-code the most significant digit is determined by letting this be the only one that has a value in a specific range. In this example, one lets one row of four begin in the position 0-1 in the number series to indicate that this row relates to the least significant digit in a y-coordinate, and the other three begin in the position 2-6. In y-direction, there is thus a series of numbers as follows:

(2-6) (2-6) (2-6) (0-1) (2-6) (2-6) (2-6) (0-1) (2-6)...







7 = 1 6 3 5. Between the last starting position (5) and the first starting position, the numbers 0-19 are coded in the mixed base, and by adding up the representations of the numbers 0-19 in the mixed base, one obtains the total difference between these columns. A naive algorithm to do so is to generate these twenty numbers and directly add up their digits. The resulting sum is called  $s$ . The sheet of paper or writing surface will then be given by  $(5-s) \bmod 7$ .

In the example above, an embodiment has been described, in which each position is coded with  $4 \times 4$  symbols and a number series with 7 bits is used. Of course, this is but an example. Positions can be coded with a larger or smaller number of symbols. The number of symbols need not be the same in both directions. The number series can be of different length and need not be binary, but may be based on another base. Different number series can be used for coding in x-direction and coding in y-direction. The symbols can have different numbers of values. As is evident from the above, a coding with  $6 \times 6$  symbols is presently preferred, each symbol being capable of assuming four values. A person skilled in the art can readily generalize the above examples to concern such coding.

In the example above, the marking is a dot but may, of course, have a different appearance. For example, it may consist of a dash or some other indication which









Of course, a smaller or large number of dots than described above can be used to define a point on the imaginary surface and a larger or smaller distance between the dots can be used in the pattern. The examples above are only given to demonstrate a presently preferred implementation of the pattern.

#### Position Code on the Product

Figs 5a shows the sheet 1 in Fig. 1 once more, the different subsets of the position-coding pattern being marked with different kinds of hatching. The sheet comprises nine different areas which correspond to the writing surface 3, the address area A and the seven activation icons 7a-g. Each of these areas is provided with a separate subset of the position-coding pattern. Fig. 5b shows corresponding coordinate areas on the imaginary surface I, the areas being given the same reference numerals with the  $\sim$  sign added. The imaginary surface consists of the coordinate area  $(0,0; x_n,0; x_n;y_m; 0,y_m)$ . It is evident that the position code is not continuous over the entire product but that the different subsets are fetched from different parts of the imaginary surface. The different coordinate areas on the imaginary surface are dedicated to the respective purposes. This means that a completely new layout of the sheet can be created without requiring any modifications in the device which is to record information from the writing surface 3, interpret address information from the address area A and detect

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the various activation icons 7a-g and initiate the corresponding operations.

An activation icon can be provided by means of the coordinates for a single point on the imaginary surface. In order to simplify detectability, a corresponding subset of the position-coding pattern can be repeated several times over the activation area of the activation icon. The repetition of the subset, however, must occur with a certain blank so that the subset which codes the coordinates for the point can be detected unambiguously.

Alternatively, the entire sheet 1 could be provided with a position-coding pattern which codes coordinates for a continuous coordinate area on the imaginary surface. In this case, each activation icon consists of a predetermined subset of the position-coding pattern which is coherent with the subset of the position-coding pattern which is located on the writing surface. The activation icon is detected when the pen has first been raised from the writing surface and then the coordinates of one or more points which are dedicated to the activation icon are recorded. The requirement that the pen be raised before the detection of the activation icon has the advantage that it is possible to distinguish between the user unintentionally writing over the activation icon and the user intentionally placing the pen on the activation icon to initiate the predetermined operation.



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ing surface 3, the address area A and the activation icons 7a-7g.

The casing contains essentially an optics part, and electronic circuitry part and a power supply. The optics part comprises at least one IR light-emitting diode 13 for illuminating the surface which is to be imaged and a light-sensitive area sensor 14, such as a CCD or CMOS sensor, for recording a two-dimensional image. The device may also comprise a lens system (not shown).

The power supply to the device is obtained from a battery 15 which is mounted in a separate compartment in the casing.

The electronic circuitry part comprises a signal processor 16. The signal processor 16 is accomplished by means of a suitably programmed microprocessor. It contains software to analyze images from the sensor to produce a digital representation of the graphical information which is provided on the writing surface and to detect the activation icons. It also comprises software to initiate and/or carry out the operations determined by the activation icons. It may also comprise user software, such as address book program to allow the user to keep track of address information, calendar program to allow the user to keep track of calendar information, such as meetings, birthdays, and other information entered in a calendar or diary, as well as to-do-list program so that the user can enter tasks which she is to carry out.





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and information about which operation is to be carried out to an external unit.

Finally, the device may also comprise a display 21 for showing, for instance, recorded information. The display is not necessary. Showing can, if at all necessary, be carried out on a display of an external unit.

Applicant's Swedish Patent No. 9604008-4 describes a device for recording text. If programmed in a suitable way, this device can be utilized to record information which is being written in a writing surface provided with a position code, to detect activation icons, and to initiate/carry out operations activated by the activation icon.

In an alternative embodiment, the electronic circuitry part may comprise or be integrated with a mobile telephone unit which comprises a mobile telephone transceiver, which makes it possible to telephone, send faxes, and send e-mail messages to an external unit in the form of a telephone, a fax machine or a computer.

Furthermore, the device may have an indicating means 22, such as a light-emitting diode or a buzzer or a vibrator which indicates when the device detects the position code, so that the user knows that the written information is actually recorded electronically.

#### THE FUNCTION

The function of the notepad sheet in Fig. 1 and the device in Fig. 6 will be described below.











phone icon, it starts a program for dialing a telephone number with the aid of the mobile telephone. If all information written on the writing surface 3 is subjected to character recognition, the dialing program can fetch the figures of the telephone number directly from the recorded information. Alternatively, the user can write the figures in the character recognition area A, whereby they are automatically subjected to character recognition. The program shows the figures on the display 21 and waits for the user to confirm by pressing a button that the number is correct and that it should actually be dialed. After the confirmation, the number is dialed automatically and the user can speak to Jack.

Another example of how the notepad and the device can be used is as follows. The user remembers she is supposed to pick up her car at 4 p.m. at the garage. She writes a note on her notepad "pick up car at 4 p.m.", see Fig. 1, by means of the pen point 18 of the device. This information is recorded in the device by means of the position code. The user then places the pen on the calendar program icon 7e, whereupon the pen detects it and activates the calendar program. The program fetches the recorded information. Naturally, if the information is in the form of position indications it can only be stored as position indications in the calendar program. In this case, the program can suggest that the note be entered under today's date and ask the user to confirm this by













